Master of IT in Business

Course Description

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*A compulsory pre-requisite course is required.

These courses cannot be taken in student's first term of study and requires a compulsory pre-requisite course. As a result, some full-time students may need to extend to their fourth term of study in order to read these courses. Only students with special exemptions can be allowed to read these courses in their first term of study.

% The AI Translational Research Seminar is a graduation requirement (without credit) for AI track students.

ARTIFICIAL INTELLIGENCE (AI)

Algorithm Design & Implementation

This course is designed for students who wish to develop their algorithmic skills and prepare themselves for deeper courses in artificial intelligence. It aims to train students in their algorithmic thinking, algorithm design, algorithm implementation and the analysis of algorithms. This course covers a wide range of topics, including data structures, searching, divide-and-conquer, dynamic programming, greedy algorithms, graph algorithms, intractable problems, NP-completeness and approximate algorithms. Students are expected to design and implement efficient algorithms to solve problems in assignments, which require students to reiterate and continuously improve their solutions. At the end of the course, students should have the mindset to achieve more efficient algorithmic solutions as much as possible for business problems. Students should also be inspired to learn more after this course by taking our electives from Artificial Intelligence track.

Upon completion of the course, students will be able to:

- Explain important algorithms and their use cases
- Apply algorithms in business applications
- Analyze algorithms in terms of time efficiency and space efficiency
- Evaluate algorithms based on their applicability and efficiency
- Create algorithms in some new or unique business applications

Note: "Python Programming & Data Analysis" or "Computational Thinking with Python" must be taken either prior to/at the same time as this course.

Artificial Intelligence and Uncertainty Reasoning*

Artificial Intelligence (AI) aims to augment or substitute human intelligence in solving complex real world decision making problems. This is a breadth course that will equip students with core concepts and practical know-how to build basic AI applications that impact business and society. Specifically, we will cover search (e.g., to schedule meetings between different people with different preferences), probabilistic graphical models (e.g. to build an AI bot that evaluates whether credit card fraud has happened based on transactions), planning and learning under uncertainty (e.g., to build AI systems that guide doctors in recommending medicines for patients or taxi drivers to "right" places at the "right" times to earn more revenue), image processing (e.g., predict labels for images), and natural language processing (e.g., predict sentiments from textual data).

Upon finishing the course, students are expected to understand basic concepts, models and methods for addressing key AI problems of:

- Representing and reasoning with knowledge
- Perception
- Communication
- Perception
- Decision Making

Note: "Algorithm Design & Implementation" is the pre-requisite for this course.

Machine Learning Engineering*

In this course, students will learn building pipelines to deploy machine models on a cloud system including data cleaning, data validation, model training, model deployment, model maintenance and the combined practices of continuous integration and continuous deployment (CICD). Students are expected to reach the competency of building machine learning production systems end-to-end.

Applied Machine Learning*

This course teaches machine learning methods and how to apply machine learning models in business applications. Students trained by this course are expected to have developed the abilities to (i) process and analyze data from business domains; (ii) understand various machine learning methods, algorithms and their use cases; (iii) combine machine learning methods and algorithms to build machine learning models for specific business problems, and (iv) compare, justify, choose and explain machine learning models in the designated business scenarios. This course covers both unsupervised learning algorithms including principal component analysis, k-means, expectation-maximization, spectral clustering, topic models; and supervised learning methods including regression, logistic regression, NaÃ¯ve Bayes classifiers, support vector machines, decision trees, ensemble learning, neural networks, deep learning models, convolutional neural networks and recurrent neural networks.

Upon completion of the course, students will be able to:

- Explain machine learning methods, algorithms and their use cases
- Apply machine learning models in business applications
- Analyze the applicability of machine learning models
- Evaluate machine learning models by considering their effectiveness, efficiencies and the business use cases
- Create machine learning models by combining several basic machine learning methods and algorithms

Note: "Python Programming & Data Analysis" or "Computational Thinking with Python" is the pre-requisite for this course

Deep Learning for Visual Recognition[#]

Computer vision is to enable a machine to see and interpret images in a human like manner. It is a key component in artificial intelligence applications like surveillance, data mining and automation. It is also a field which pioneered the use of deep learning techniques that are now widespread in machine learning.

This course teaches: a) The current mathematical framework for machine learning; b) Machine learning techniques from a computer vision perspective; c) Deep learning for computer vision. Students are expected to know python programming and have a solid mathematical foundation.

Upon completion of the course, students will be able to:

- Analyze and visualize data using Python
- Explain machine learning theories and how deep-learning works
- Apply machine learning/deep-learning methods on various problems and datasets
- Evaluate machine learning problems and choose appropriate methods for the problem
- Create machine learning solutions by integrating several methods and algorithms

Note: "Python Programming & Data Analysis" or "Computational Thinking with Python" is the pre-requisite for this course.
"Applied Machine Learning" must be taken either prior to or at the same time as this course.

AI System Evaluation[*]

This course teaches methods to evaluate an AI system's quality beyond accuracy, such as robustness, fairness, and privacy. Students trained by this course are expected to have developed the abilities to (1) understand various quality criteria and security issues associated with AI systems; (2) conduct analysis methods such as testing and verification to evaluate AI systems; and (3) apply data-processing, model training or post-processing methods to improve AI systems' quality according to the quality criteria. The course covers various definitions such as robustness, fairness, and privacy, as well as methods for evaluating AI systems against them, such as adversarial perturbation, coverage-based fuzzing, and methods of improving AI systems such as data augmentation, robustness training, and model repair.

Upon completion of the course, students will be able to:

- Evaluate AI systems' quality in terms of robustness, fairness and privacy
- Explain the causes of violating of robustness, fairness and privacy
- Apply model quality improving methods to model robustness, fairness and privacy.

Note: "Applied Machine Learning" or "Deep Learning for Visual Recognition" or "Natural Language Processing for Smart Assistants" or "Machine Learning Engineering" is the prerequisite for this course.

Natural Language Processing for Smart Assistants[*]

This course introduces Natural Language Processing (NLP) technologies, which cover the shallow bag-of-word models as well as richer structural representations of how words interact with each other to create meaning. At each level, traditional methods as well as modern techniques will be introduced and discussed, which include the most successful computational models. Along the way, learning-based methods, non-learning-based methods, and hybrid methods for realizing natural language processing will be covered. During the course, the students will select at least 1 course project, in which they will practise how to apply what they learn from this course about NLP technologies to solve real-world problems.

Upon completion of the course, students will be able to:

- Explain the basic concepts of human languages and the difficulties in understanding human languages
- Acquire the fundamental linguistic concepts and algorithmic concepts that are relevant to NLP technologies
- Analyze and understand state-of-the-art methods, statistical techniques and deep learning-based techniques relevant to NLP technologies, such as RNN, LSTM, and Attention
- Obtain the ability or skill to leverage the exiting methods or enhance them to solve NLP problems
- Implement state-of-the-art algorithms and statistical techniques for specific NLP tasks, and apply state-of-the-art language technology to new problems and settings

Note: "Python Programming & Data Analysis" or "Computational Thinking with Python" is the pre-requisite for this course.
"Applied Machine Learning" must be taken either prior to or at the same time as this course.

Query Processing and Optimisation

This course aims to educate students on techniques for writing more efficient, less resource-intensive, and "" in a consequence "" faster database query statements. Such queries are more suitable for application in real-world environments, such as production databases with a high volume of parallel requests, environments executing repeated queries at short intervals, or big data processing systems. To do so, the course discusses operations executed by databases to process queries, performance cost of executing certain queries, and examines the impact that code of similar queries expressed through different statements has on database response times.

This course exposes students to selected techniques they can apply to assess and change performance characteristics of database queries. These techniques include special statements for analysing query execution plans, application of structural Optimisations (selection of data types, normalization, various types of indexes, different forms of partitioning, etc.), and application of behavioural Optimisations (with focus on complex queries using joins, or subqueries). To cover a wide variety of scenarios, the course includes a classic relational database MySQL/MariaDB, a data warehouse software Apache Hive, as well as a document-oriented NoSQL database MongoDB.

Although this course does not have formal pre-requisites, it is recommended that students are familiar with basic concepts of relational databases (e.g. tabular design, issuing basic DDL/DML queries in SQL) and working knowledge of operating systems (e.g. use of a command-line terminal, file system navigation). As this is a technology-oriented course with a strong technical aspect, possessing these skills enables students to thrive and enjoy the learning experience.

Introduction to Reinforcement Learning*

Reinforcement learning is a form of machine learning where an agent learns how to behave by performing actions and evaluating feedback from an environment which may be inherently stochastic. One will gain an appreciation of what goes on behind the scenes hearing about computer programs outwitting the best human players in chess or go.

In this course, students will understand the fundamentals principles of reinforcement learning, and apply their knowledge to solve simple scenarios in which the outcome of each action may not be immediately apparent. Concepts to be imparted includes value functions, policy and value iteration, q-learning, Monte Carlo methods and temporal-difference learning, as well as the incorporation of neural networks as universal function approximators. Towards the end of the course, the motivation and foundations of evolutionary algorithm and particle swarm optimization will be introduced. Students will also be trained on their learn-to-learn skills by completing a course project. With the evergreen foundations acquired here, students will be well poised to dive deeper according to their personal interests or aspirations in this domain.

Note: "Artificial Intelligence and Uncertainty Reasoning" is the pre-requisite for this course.

Recommender Systems*

With pervasive digitization of our everyday lives, we face an increasing number of options, be it in which product to purchase, which movie to watch, which article to read, which applicant to interview, etc. As it is nigh impossible to investigate every possible option, driven by necessity, product and service providers rely on recommender systems to help narrow down the options to those most likely of interest to a target user.

- Neighborhood-based collaborative filtering
- Matrix factorization for explicit and implicit feedback
- Context-sensitive recommender systems
- Multimodal recommender systems
- Deep learning for recommendations

Another important part of the course covers various aspects that impact the effectiveness of a recommender system. This includes how it is evaluated, how explainability is appreciated, how recommendations can be delivered efficiently, etc.

In addition to covering the technical fundamental of various recommender systems techniques, there will also be a series of hands-on exercises based Cornac (https://cornac.preferred.ai), which is a Python recommender systems library that supports most of the algorithms covered in the course.

Upon completion of the course, students will be able to:

- To understand the application of recommender systems to businesses
- To formulate a recommendation problem appropriately for a particular scenario
- To understand various forms of recommendation algorithms
- To apply these methods or algorithms on various datasets
- To identify issues that may affect the effectiveness of a recommender system

Note: "Algorithm Design & Implementation" is the pre-requisite for this course.
"Applied Machine Learning" must be taken either prior to or at the same time as this course.

Generative AI with LLMs*

This course provides a comprehensive introduction to generative AI using large language models (LLMs). Students will learn to use the techniques and tools necessary for customising, fine-tuning, deploying and evaluating state-of-the-art generative AI systems. At the end of the course, students will have gained hands-on experience with the most advanced LLMs capable of generating human-like text, performing tasks, and improving a variety of applications across industries.

Note: "Computational Thinking with Python" is the pre-requisite for this course.

"Applied Machine Learning" must be taken either prior to or at the same time as this course.

AI Translational Research Seminar[%] *(Without Credit)*

This series of 10 seminars will be conducted by various SCIS faculty members who will share their innovative translational projects related to AI that take place in their respective centres/labs. Through these seminars, you will learn about:

1. Translating artificial intelligence to your business. Industry practitioners will be invited to share their experiences.
2. A wide spectrum of the different application areas and will be encouraged to ask the right questions and think out of the box.

This module is a graduation requirement (without credit) for AI track students.

Agentic AI for Intelligent Autonomy

This course explores the Agentic Revolution""the emerging paradigm where AI systems act as interactive, adaptive agents shaping and responding to human needs. Students will engage with the principles of building intelligent agents, with emphasis on learning, reasoning, and adaptation, while critically analyzing the challenges of ethics, alignment, and trust in human-AI interaction. The course will also survey future frontiers and applications, preparing students for the design and responsible deployment of next-generation intelligent systems.

Prompt Engineering for LLMs (0.5 CU)

Prompt engineering is vital to the application of pre-trained large language models (LLMs). In this course, students will learn the rules and approaches to design effective prompts to interact with the LLMs to extract the best responses. Students are expected to apply prompt engineering on LLMs for various applications.

AI in Financial Markets Forecasting (0.5 CU)

The course will cover the use of AI techniques for time series modelling and forecasting for financial applications, e.g. portfolio management. It will cover traditional, machine learning and deep learning-based techniques. The course will also cover the latest developments, e.g. use of network and multimodal data for time series modelling and forecasting as well as foundational models for time series modelling.

Human-AI Interaction Design

This course provides a general introduction to the applications of AI in user-facing domains, exploring the transformative potential of AI systems in everyday life. Key considerations and guidelines for Human-AI interaction will be covered, focusing on the principles of effective design and ethical deployment. Students will also examine interaction design for AI applications and explore the dynamics of Human-AI teaming, preparing them to create collaborative, user-centered intelligent systems.

CYBERSECURITY (CYB)

Cybersecurity Technology & Applications

This course provides an introduction to cybersecurity. The focus is on basic cryptographic techniques, user authentications, software security, and various network security topics. The course emphasizes on the applications of such technology in real-world business scenarios, with case studies that examine how these ideas can be used to protect existing and emerging applications. Examples include secure email communications, secure electronic transactions over the Internet, secure e-banking, data confidentiality and privacy in cloud computing, and secure protocols in realistic networking setups. Although the course covers fundamentals of cryptography, our emphasis is not on its mathematical background and security proofs, but rather on how such building blocks could be applied to satisfy business, communication, and networking needs.

Upon completion of the course, students will be able to:

- Understand basic security concepts, models, algorithms, and protocols
- Conduct basic software vulnerability analysis and construct corresponding exploits
- Design and implement secure user authentication on Internet facing servers
- Formulate security requirements for real-world computing applications
- Analyze latest security mechanisms in use

Enterprise Cryptography

This course covers the design and application of state of the art cryptographic techniques including post quantum cryptography and zero-trust architecture within large organizations to protect sensitive data, ensure secure communications, and comply with regulatory requirements. It is an essential component of corporate cybersecurity strategies, helping businesses safeguard against data breaches, cyberattacks, and insider threats.

The course emphasizes real-world use cases, including migration to post quantum cryptography to be compliant with new data protection and secure communication standards. Through hands-on exercises, students will gain experience implementing and analyzing cryptographic systems while understanding their limitations and vulnerabilities.

Cloud Security

This course covers security principles, architectures, and best practices for cloud. It covers cloud computing models, identity and access management (IAM), data protection, compliance frameworks, and risk management in cloud environments.

Students will explore secure cloud architectures, application security, and emerging trends such as Zero Trust and AI-driven cloud security, equipping students with the skills to manage security of cloud-based applications across various industries. This course will include hands-on labs using public cloud platforms (e.g., AWS) and open-source cloud security tools.

AI-Driven Security Analysis

This course is designed to equip students with the skills to conduct comprehensive security assessments of IT systems by integrating conventional security analysis techniques with AI-powered methods.

This course covers vulnerability assessment and penetration testing using AI-powered static & dynamic analysis tools, intrusion detection using AI-powered IDS tools, AI-driven malware/anomaly analysis in sandbox environments, and Agentic AI-based security automation (automating the workflows of vulnerability assessment, intrusion detection, and malware analysis).

Strategic Cybersecurity Management

This course provides an in-depth understanding of how to manage cybersecurity risks strategically, ensuring alignment with business objectives and regulatory requirements.

Students will explore frameworks for risk assessment, governance models, and the integration of cybersecurity into organizational strategies. Topics include aligning cybersecurity initiatives with business goals, managing compliance with industry standards and regulations, and developing incident response and resilience strategies.

Agile & DevSecOps

Traditional waterfall approach to software development is not flexible enough to support digital strategies to deliver business results fast. Organisations need to become more agile in systems analysis and design beyond a linear sequential flow. Adopting DevSecOps delivers business value by increasing the speed of application releases to production, thereby, shortening the time to market. In this module, you will learn about Agile principles and model, DevSecOps practices and large-scale experimentation (A/B-testing) approach.

Upon completion of the course, students will be able to:

- Understand Agile principles and DevSecOps concepts
- Apply Agile principles and best practices
- Select appropriate Agile practices for different scenarios
- Develop a plan to implement Agile practices in a digital enterprise

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Threat Intelligence & Incident Response

This course provides an in-depth understanding of cyber threat intelligence (CTI), incident management lifecycle, and their role in defending an organization's assets.

Students will learn how to gather, analyze, and apply threat intelligence to identify potential threats, understand adversarial tactics, proactively defend & respond to cyberattacks. Key topics include intelligence frameworks, threat actor profiling, CTI collection and analysis, leveraging frameworks like MITRE ATT&CK and SIEM, and integrating CTI into security operations. The course emphasizes real-world scenarios, enabling students to turn raw threat data into actionable intelligence.

AI System Evaluation*#

This course teaches methods to evaluate an AI system's quality beyond accuracy, such as robustness, fairness, and privacy. Students trained by this course are expected to have developed the abilities to (1) understand various quality criteria and security issues associated with AI systems; (2) conduct analysis methods such as testing and verification to evaluate AI systems; and (3) apply data-processing, model training or post-processing methods to improve AI systems' quality according to the quality criteria. The course covers various definitions such as robustness, fairness, and privacy, as well as methods for evaluating AI systems against them, such as adversarial perturbation, coverage-based fuzzing, and methods of improving AI systems such as data augmentation, robustness training, and model repair.

Upon completion of the course, students will be able to:

- Evaluate AI systems' quality in terms of robustness, fairness and privacy
- Explain the causes of violating of robustness, fairness and privacy
- Apply model quality improving methods to model robustness, fairness and privacy

Note: "Applied Machine Learning" or "Deep Learning for Visual Recognition" or "Natural Language Processing for Smart Assistants" or "Machine Learning Engineering" is the prerequisite for this course.

DATA SCIENCE & ANALYTICS (DSA)

Data Management

In the digital age, data is considered as a very valuable resource and one of the most important assets of any organisation. It forms the basis on which an organisation makes decisions. Consequently, we would like the data to be accurate, complete, consistent, and well organized. This course focuses on relational databases, one of the most common approaches adopted by industry to manage structured data. It covers fundamentals of relational database theory, important data management concepts, such as data modelling, database design, implementation, data access, and practical data-related issues in current business information systems.

A series of in-class exercises, tests, pop quizzes, and a course project help students understand the covered topics. Students are expected to apply knowledge learned in the classroom to solve many problems based on real-life business scenarios, while gaining hands-on experience in designing, implementing, and managing database systems.

Upon completion of the course, students will be able to:

- Understand the role of databases in integrating various business functions in an organisation
- Understand data modelling, conceptual, logical, and physical database design
- Apply the fundamental techniques of data modelling to a real project
- Query a database using Structured Query Language (SQL)
- Use commercial database tools such as MySQL

Data Analytics Lab

This course is about data analytics techniques and data-driven knowledge discovery. It aims to convey the principles, concepts, methods and best practices from both statistics and data mining, with the goal of discovering knowledge and actionable insights from real world data.

In this course, you will be exposed to a collection of data analytics techniques and gain hands-on experiences on using a powerful and industry standard data analytics software. However, you are not required to formulate or devise complex algorithm, nor be required to be a master of any particular data analytics software. You should, on the other hand, focus your attention on the use and value of the techniques and solution taught to discover new knowledge from data and how to make data-driven decisions in an intelligent and informed way. You will be also trained to understand the statistics rigour and data requirements of these techniques.

Upon completion of the course, students will be able to:

- Discover and communicate business understanding from real world data using data analytics approaches
- Extract, integrate, clean, transform and prepare analytics datasets
- Perform Exploratory Data Analysis (EDA) and Confirmatory Data Analysis (CDA)
- Calibrate and interpret explanatory models
- Build and evaluate predictive models
- Visualise, analyse and build forecasting models with time-series data
- Perform the above data analysis tasks by using SAS JMP Pro and/or SAS Enterprise Miner

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Data Science for Business*

This course is aimed to provide both an overview and an in-depth exposition of key topics of data science from the perspective of a data-driven technology-enabled paradigm for business application and innovation.

In this age of big data and machine intelligence, almost all aspects of business are bound to be profoundly impacted by this new wave of data and technology explosion. Moreover, disruptive innovation nowadays spring more often from the engine of big data and the intelligence extracted from them. It is our aim to help students gain a deeper look into data and computation on them, such that:

1. Students learn the state-of-the-art of the data technology at the current frontier, as well as the possibilities to explore future innovations.
2. Students learn the pitfalls and limitations of what data and computations can do, to gain a technologically-savvy mindset and decision system.
3. Students understand and learn to evaluate the relevant key factors that interplay in data science from a business perspective.

Upon completion of the course, students will be able to:

- Analyse business problems from a computational perspective and translate them into corresponding data science tasks
- Identify data in the business ecosystem and perform data inventorization and mapping for the business problem of interest
- Design and integrate data science concepts and notions to customize for the business problem
- Design and construct corresponding models and algorithms to derive a computational solution

- Identify appropriate metric and criteria to evaluate the computation results
- Interpret the computational solution in the business setting and translate back into actionable intelligence
- Propose action plans for the closed-loop data ecosystem to complete the analytical journey for iterative model improvement and result optimisation
- Evaluate non-technical aspect of the solution in terms of business, social and ethical aspect, including bias, fairness, cost, privacy and so on

Note: "Python Programming & Data Analysis" or "Computational Thinking with Python" is the pre-requisite for this course.

Big Data: Tools & Techniques

Big Data has become a key consideration when organisations today develop strategic outlook of the consumer and market trends. Big Data sets have become an enabler to organisations in developing strategies and plans to develop compelling product and services and differentiated customer experiences at low cost by optimizing operations and processes.

Business analytics today increasingly leverages not just the traditional structured data sets to answer business questions, but also the newer forms of Big Data that can help answer new questions or even answer old questions in newer ways. Big Data is helping provide richer and newer insights into questions analytics has been answering by modeling for a richer customer and operations scenario.

As such, it is incumbent on practitioners of advance analytics to be intimately familiar with technologies that help store, manage and analyze these Big Data streams (sensor data, text data, image data etc.) in an integrated way along with more traditional data sets (e.g. CRM, ERP etc.)

This course is intended to equip students with an appreciation and a working knowledge of Big Data technologies that are prevalent in the market today along with how and when to use Big Data technologies for specific scenarios. This course will provide a foundation to the Hadoop framework (HDFS, MapReduce) along with Hadoop ecosystem components (Pig, Hive, Spark and Kafka). The course will also cover key Big Data architectures from the point of view of both on-premise environments and public cloud deployments.

Upon completion of the course, students will be able to:

- Explain application of Big Data technologies and their usage in common business applications
- Compare, contrast and select, Hadoop stack components based on business needs and existing architectures
- Analyze and explore data sets using Big Data technologies
- Design high-level solution architecture for different business needs both on premise and on cloud

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Applied Data Science for Customer Insights (SMU-X)

Most organisations have accumulated vast customer transaction data yet struggle to convert it into strategic advantage. Students will learn to view a business through five analytical lenses — customer heterogeneity, period-over-period dynamics, cohort behaviour, cross-cohort comparison and overall customer-base health — building a rigorous, data-driven understanding of how customers are acquired, retained and developed. The course then extends into advanced customer analytics: segmentation, survival analysis, market basket analysis, recommendation systems etc. All lab exercises use Python (Jupyter notebooks).

The goals of this course are:

- Develop a customer-centric analytical mindset by applying the Customer-Base Audit framework (Five Lenses).
- Build proficiency in Python-based customer analytics, including segmentation, RFM and recommendation systems.
- Articulate analytical findings for management communication through structured presentations and reports.
- Plan, execute and present a customer analytics project using real industry data.

Applied Data Science in Operations

Every service sector business is faced with operations related problems including demand forecasting, inventory management, distribution management, capacity planning, resource allocation, work scheduling, and queue & cycle time management.

Very often, the business owner knows that problems exist but has no idea what caused the problems, and therefore does not know what to do to solve the problems. In this course, students will be exposed to the Data and Decision Analytics Framework which helps the analyst identify the actual cause of business problems by collecting, preparing, and exploring data to gain business insights, before proposing what objectives and solutions can and should be done to solve the problems. Such a framework combines identification of the root causes by data analytics, and proposing solutions supported by decision analytics.

The goals of this course are for students to (a) develop a strong understanding of the theory, concepts and techniques of operations management and data driven analytics, and (b) apply that understanding in creating cutting-edge business analytics applications and IT solutions for service industry companies to gain operation insights and business improvements. Students will apply the Data and Decision Analytics Framework to solve several operations focused case studies. This framework is an expansion of a typical operations management solution methodology to include data analytics so as to exploit the linkages across processes, data, operations, analytics and technology, to offer businesses alternative solutions to operations problems.

Upon completion of the course, students will be able to:

1. Explain the theory and concepts of several operations management areas
2. Explain the Data and Decision Analytics framework for solving operations related problems
3. Apply the theory and concepts, and Data and Decision Analytics framework into solving operations related problems

4. Relate the key data and processes related to operations problems in several business domains
5. Acquire knowledge and skills in several data analytics tools including SAS Enterprise Guide, SAS O/R, SAS Simulation Studio, SAS Viya
6. Build analytics models to perform data analysis and obtain insights

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Applied Data Science in Social Networks

This course focuses on data analytics in the context of social media. Increasingly people interact with each other on social media on a daily basis, which generates a huge amount of social data. We are primarily interested in two types of social data: social relationship networks, such as friendship networks and professional networks, and social text data such as user reviews and social status updates. Thus, this course integrates both network (formerly known as graph) mining and text analytics, with more emphasis on the network portion.

This course will prepare you with the fundamental data science and programming skills to process and analyse social data, in order to reveal valuable insights and discover knowledge for making better decisions in business applications. You will not only learn the different theories and algorithms for social data analytics, but also have a chance to apply them to real-world problem solving through in-class lab sessions and course project.

The main programming language used in the lab sessions of the course is Python. Throughout the course, progressively more advanced tools and algorithms for social analytics will be introduced. Students are expected to complete a group project, to demonstrate a set of full-stack abilities from developments to analytics, knowledge discovery, and business applications.

Upon completion of the course, students will be able to:

1. Crawl and process social network and text data
2. Perform analytics on social text data
3. Perform graph mining algorithms on social network data
4. Discover knowledge and insights gained from analysing social data
5. Apply social analytic techniques on business problems

Visual Analytics & Applications

In this competitive global environment, the ability to explore visual representation of business data interactively and to detect meaningful patterns, trends and exceptions from these data are increasingly becoming an important skill for data analysts and business practitioners. Drawing from research and practice on Data Visualisation, Human-Computer Interaction, Data Analytics, Data Mining and Usability Engineering, this course aims to share with you how visual analytics techniques can be used to interact with data from various sources and formats, explore relationship, detect the expected and discover the unexpected without having to deal with complex statistical formulas and programming.

The goals of this course are:

1. To train you with the basic principles, best practices and methods of interactive data visualisations,
2. To provide you hands-on experiences in using commercial off-the-shelf visual analytics software and programming tools to design interactive data visualisations

Upon completion of the course, students will be able to:

- Understand the basic concepts, theories and methodologies of visual analytics
- Analyse data using appropriate visual thinking and visual analytics techniques
- Present data using appropriate visual communication and graphical methods
- Design and implement cutting-edge web-based visual analytics application for supporting decision making

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Text Analytics & Applications

Recent advances of technologies have enabled much easier and faster ways to generate and collect data, of which unstructured textual data account for a large proportion, especially on social media. Textual data contain much valuable information for businesses, such as consumer opinions, which can help improve products and services, and users' personal interests, which can guide targeted advertising. However, textual data are inherently different from structured data. How to extract value out of the large amount of unstructured and oftentimes noisy textual data is a challenge many businesses face nowadays.

This course will introduce to the students the fundamental principles behind text analytics algorithms and some of the latest emerging technologies for solving real-world text analytics problems. The course will start with fundamentals of text analytics, including bag-of-word representation, vector space model and basic knowledge of natural language processing. Next, some common tasks in text analytics such as text classification, text clustering and topic modeling will be examined. Finally, information extraction, sentiment analysis and some other advanced topics will be discussed.

Students will acquire knowledge and skills in text analytics through lectures, class discussions, assignments and group projects using real-world datasets.

Upon completion of the course, students will be able to:

- State the properties of textual data and the differences between the analysis of structured and unstructured data
- Describe the fundamental principles behind text analytics
- Explain and compare the typical tasks in text analytics and their underlying techniques
- Apply statistical and probabilistic techniques to perform text analytics tasks
- Design and implement text analytics solutions to a chosen text mining application
- Analyse, interpret and communicate methods and outcomes of text mining experiments

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Query Processing and Optimisation

This course aims to educate students on techniques for writing more efficient, less resource-intensive, and "" in a consequence "" faster database query statements. Such queries are more suitable for application in real-world environments, such as production databases with a high volume of parallel requests, environments executing repeated queries at short intervals, or big data processing systems. To do so, the course discusses operations executed by databases to process queries, performance cost of executing certain queries, and examines the impact that code of similar queries expressed through different statements has on database response times.

This course exposes students to selected techniques they can apply to assess and change performance characteristics of database queries. These techniques include special statements for analysing query execution plans, application of structural Optimisations (selection of data types, normalization, various types of indexes, different forms of partitioning, etc.), and application of behavioural Optimisations (with focus on complex queries using joins, or subqueries). To cover a wide variety of scenarios, the course includes a classic relational database MySQL/MariaDB, a data warehouse software Apache Hive, as well as a document-oriented NoSQL database MongoDB.

Although this course does not have formal pre-requisites, it is recommended that students are familiar with basic concepts of relational databases (e.g. tabular design, issuing basic DDL/DML queries in SQL) and working knowledge of operating systems (e.g. use of a command-line terminal, file system navigation). As this is a technology-oriented course with a strong technical aspect, possessing these skills enables students to thrive and enjoy the learning experience.

Geospatial Analytics & Applications

Geospatial data and analytics are essential components of the toolkit for decision analysts and managers in the highly uncertain and complex global economy. The global geospatial analytics market was estimated to be nearly USD60 billion in 2020 and projected to grow at a CAGR of more than 10% over 2021-2028. Government and private industry around the world are investing heavily in both the generation of geospatial data, management and analytical systems for the effective translation of geospatial data into useful information and insights for business decision making. Emergent global challenges, such as the COVID-19 pandemic, has also brought about an unprecedented surge in the demand for geospatial analytics talents.

This course will equip students with the fundamental concepts, understanding and tools in geospatial analytics to develop effective solutions that will address the needs in geospatial analysis for both public and private sectors. The main components of this course will be on geospatial information systems, geospatial data acquisition and modelling and the principles and methods for geospatial data management, visualization, analysis and network modelling. The course will provide the opportunities for students to develop practical problem-solving, decision analysis and digital skills to address the needs for geospatial analytic talents. There will be hands-on exercises and case studies to facilitate the translation of these knowledge into practical skills to solve real-world problems.

Upon completion of the course, students will be able to:

- Understand the basic concepts of Geospatial Information Systems and geospatial analytics,
- Understand the data transformation and wrangling techniques to stage geospatial data for useful analysis
- Use appropriate geovisualisation and basic geospatial analytical techniques to analyse and visualise geographical data,
- Understand the basic concepts and methods of mapping functions and algebra for geospatial data analysis,
- Apply geospatial analysis methods to visualize, model and mine geospatial data for insightful patterns and relationships to address real-world problems
- Design and implement solutions to solve spatially enabled geospatial analytics problems.

Applied Machine Learning*

This course teaches machine learning methods and how to apply machine learning models in business applications. Students trained by this course are expected to have developed the abilities to (i) process and analyze data from business domains; (ii) understand various machine learning methods, algorithms and their use cases; (iii) combine machine learning methods and algorithms to build machine learning models for specific business problems, and (iv) compare, justify, choose and explain machine learning models in the designated business scenarios. This course covers both unsupervised learning algorithms including principal component analysis, k-means, expectation-maximization, spectral clustering, topic models; and supervised learning methods including regression, logistic regression, NaÃ¯ve Bayes classifiers, support vector machines, decision trees, ensemble learning, neural networks, deep learning models, convolutional neural networks and recurrent neural networks.

Upon completion of the course, students will be able to:

- Explain machine learning methods, algorithms and their use cases
- Apply machine learning models in business applications
- Analyze the applicability of machine learning models
- Evaluate machine learning models by considering their effectiveness, efficiencies and the business use cases
- Create machine learning models by combining several basic machine learning methods and algorithms

Note: "Python Programming & Data Analysis" or "Computational Thinking with Python" is the pre-requisite for this course.

Generative AI with LLMs*

This course provides a comprehensive introduction to generative AI using large language models (LLMs). Students will learn to use the techniques and tools necessary for customising, fine-tuning, deploying and evaluating state-of-the-art generative AI systems. At the end of the course, students will have gained hands-on experience with the most advanced LLMs capable of generating human-like text, performing tasks, and improving a variety of applications across industries.

Note: "Computational Thinking with Python" is the pre-requisite for this course.

"Applied Machine Learning" must be taken either prior to or at the same time as this course.

Prompt Engineering for LLMs (0.5 CU)

Prompt engineering is vital to the application of pre-trained large language models (LLMs). In this course, students will learn the rules and approaches to design effective prompts to interact with the LLMs to extract the best responses. Students are expected to apply prompt engineering on LLMs for various applications.

Applied Data Science in Healthcare (0.5 CU)

The World Health Organisation has projected a shortfall of 18 million health workers by 2030. Singapore is facing a similar scenario of healthcare workforce shortfalls, exacerbated by a fast-aging population. In order to future-proof and ensure the continued accessibility, quality and affordability of healthcare, the Singapore government has made three key shifts to move beyond hospital to the community, beyond quality to value, and beyond healthcare to health. In order to achieve this goal, analytics and data science can play a key enabling role to alleviate the increasing burden in our healthcare systems.

Health systems worldwide have embarked on the drive towards digitalisation for over the past 20 years. The ability to capture, analyse and synthesize data for high priority and impactful health service delivery and clinical processes is an important precursor to development of efficacious evidence-based interventions. The growth in volume, speed and complexity of healthcare data necessitates the effective use of data analytic tools and techniques to derive insights for improving patient outcomes, ensuring the sustainability of care, improving population health and ensuring the well-being of service providers.

In this course, we will introduce the characteristics of healthcare data and associated data mining challenges. We will cover various algorithms, systems and frameworks to enable the use of healthcare data for the improvement of care outcomes. The focus will be on the application of these knowledge to deal with real-world challenges in healthcare analytic applications across the entire data analytic value chain from data preparation, descriptive, predictive and prescriptive modelling techniques. We will also look at the evaluation of analytic solutions in real-world implementation.

Upon completion of the course, students will be able to:

- Understand the key elements that make up the analytics value chain for healthcare
- Achieve a good understanding on the potential and limitations of the data analytics solutions in the healthcare system
- Apply descriptive, predictive and prescriptive analytical techniques to deliver value in the health system
- Understand the key problems and challenges in the use of data and data analytical methods to derive full value from data resources
- Relate data science results to healthcare outcomes and business in the health system
- Evaluate the cost effectiveness of various interventions on the healthcare system

DIGITAL TRANSFORMATION (DT)

Digital Transformation Strategy (SMU-X)

For the past several years, we have seen many industries (including government) that were transformed by digital technology. Every business/organisation is concerned about being disrupted by technology. Every large organisation's Board and CEO are looking for business/IT leaders who can help them navigate through this disruption and want to gain competitive advantage and business value by leveraging these technologies.

This is an SMU-X course focusing on IT trends and Digital Transformation Strategy. It aims to help students understand and leverage on the latest IT trends to transform businesses. Students will work on real life business problems in the course term projects. For this course, you will learn a digital transformation strategy framework and work with real life organisations (private or public sector) in proposing such a strategy for them. You will learn the following:

1. Key technology trends, their use cases and best practices
2. Business value of IT and why it is important
3. Business strategy and digital strategy frameworks – including digital ambition and digital KPIs

The aim of this course is to equip you with a framework in which you can build digital transformation strategy for organisations, and help implement this strategy not just from a technology perspective but include business perspective and organisation change perspective. This will in turn help you gain a competitive advantage when you are seeking a new job or improve on your effectiveness by delivering strategic value to your organisation.

Upon completion of the course, students will be able to:

- Gain better understanding of IT management principles and best practices, which include IT Strategy that deliver business value, IT Governance, IT enabled innovations, IT Capabilities management etc
- Apply the knowledge gained to propose Digital Business Transformation Strategy that enables organisations to better exploit Cloud Computing, Mobile Computing, Social Computing, Advanced Analytics, Internet of Things, AI etc. in delivering business value
- Understand the challenges relating to management of change in a business setting

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Digital Organisation & Change Management

Organisations are led, managed and run by people. People is a key and fundamental factor for any organisational change to occur. To successfully transition into a new digital model, the people need to be empowered and the organisation aligned to the digital strategy. In this module, you will learn about digital talent management, principles of effective organisational change management, vision and case for change, key stakeholder management, communication and training management, and sustaining culture change.

Upon completion of the course, students will be able to:

- Understand the importance of digital talent management, future workplace and fundamentals of change management
- Apply change management methodologies, techniques and tools
- Analyse gaps in the people side of change
- Develop a change management plan as part of an organisation's digitalisation journey

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Agile & DevSecOps

Traditional waterfall approach to software development is not flexible enough to support digital strategies to deliver business results fast. Organisations need to become more agile in systems analysis and design beyond a linear sequential flow. Adopting DevSecOps delivers business value by increasing the speed of application releases to production, thereby, shortening the time to market. In this module, you will learn about Agile principles and model, DevSecOps practices and large-scale experimentation (A/B-testing) approach.

Upon completion of the course, students will be able to:

- Understand Agile principles and DevSecOps concepts
- Apply Agile principles and best practices
- Select appropriate Agile practices for different scenarios
- Develop a plan to implement Agile practices in a digital enterprise

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(Digital) Product Management

Enterprises are increasingly turning to digital innovation and investments to drive business growth. A key aspect involves digital product management playing a crucial role in orchestrating different stakeholders to drive digital business success. However, shifting from a project-centric to a product-centric model requires major changes to the existing enterprise. In the module, you will learn the fundamentals of product management, business model canvas, pricing and segmentation, digital product life cycle, and managing a product development team.

Upon completion of the course, students will be able to:

- Understand key digital product management concepts
- Apply digital product management best practices
- Implement processes to support the business and digital product development teams
- Develop a digital product plan as a part of digital transformation

Experimental Learning & Design Thinking

Human-centred design is critical in the digital world. The digital systems developed must address the fundamental needs and requirements of the user. Design thinking can be used to bring about digital innovations. Through empathy, ideation, prototyping and testing, new solutions can be rapidly co-created, experimented and enhanced in an iterative process. In this module, you will learn about business experimentation, design thinking process, ethnographic methods, customer journey mapping, systems thinking and user experience design (UX). An external industry speaker will be invited to share real-world cases and examples whenever possible.

Upon completion of the course, students will be able to:

- Understand the importance of human-centred design and key design thinking concepts
- Apply design thinking methodologies, techniques and tools
- Interpret user needs and requirements
- Design a prototype to improve user experience

Digital Governance & Risk Management

Digital governance is a subset of corporate governance that balances conformance and performance in objective setting and decision making for the digital enterprise. To achieve this outcome, management requires an enterprise-wide view of IT risks to articulate the potential risk impact on the business outcomes. Information security incidents generate a high level of anxiety associated with a fear of the unknown. In this module, you will learn about information security, digital governance styles and mechanisms, data policies and procedures, and risk management concepts and framework.

Upon completion of the course, students will be able to:

- Understand information security, digital governance and risk management concepts
- Apply digital governance and risk management framework
- Analyse the key governance issues and risks associated with a digital enterprise
- Formulate a digital governance and risk management plan for execution

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Digital Enterprise Architecture

Delivering business outcomes requires strong collaboration among different individuals and teams across the organisation. An enterprise architecture roadmap is sometimes used to illustrate the milestones, deliverables and investments required to manage change to a future state from the current state over a specific period for such outcomes. In the module, you will learn architecture principles and lifecycle methodology, different types of architecture viz. business, data and information, application and new technologies (e.g. cloud, analytics, IoT).

Upon completion of the course, students will be able to:

- Understand key enterprise architecture principles and concepts
- Apply enterprise architecture methodologies, techniques and tools
- Analyse existing gaps in the enterprise architecture
- Formulate a plan to integrate enterprise architecture with business

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Business Applications of Digital Technology

Technologies play an important enabling role in digital transformation by improving efficiency and increasing productivity. As new disruptive know-hows continue to be developed, it is vital to keep up to date on the state-of-the-art knowledge in advanced science and digital technology. In this module, you will learn about use cases and best practices in enabling technologies such as data science, artificial intelligence, mobile and wearables, blockchain, 5G and communication technologies, cloud computing, IoT, social computing, and APIs/microservices.

Upon completion of the course, students will be able to:

- Understand the fundamentals of enabling digital technologies and their trends
- Apply digital technology drivers and use cases
- Select relevant digital technology for different business scenarios
- Assemble a suite of appropriate digital technologies to enable digital transformation

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Digitalisation and Process Innovation

Processes are a series of structured and coordinated activities that an organisation performs to achieve specific business outcomes. Business processes form a vital aspect of an organisation's capability to compete in the market. Very often, processes are the basis where digital transformation happens. Process thinking can be a helpful tool to help organisations to achieve quantum improvements in business goals. Techniques are applied to eliminate non-value-adding activities, redefine job roles and streamline information flow.

With advances in digital technologies, the potential impacts of redesigned processes are further enhanced. These digital technologies allow the redesigned processes to be implemented more speedily and with higher accuracy. Digital technologies enhance process improvement initiatives leading to greater innovations to exceed customer needs and lower costs. In this module, you will learn about core business processes, process thinking, and mapping, analysing and redesigning processes with and without applying digital technologies.

By the end of this course, students will be able to:

1. Understand the importance of business processes and digital technologies.
2. Apply process improvement methodologies, techniques, and tools.
3. Map an as-is process using swim lane diagrams.
4. Analyse the key activities, roles and information flow.
5. Redesign a business process (to-be process) with and without applying digital technologies.

IT Project & Vendor Management

The aim of this course is to equip the students with the essential knowledge for leading and directing IT projects for successful implementation. The module will introduce students to key elements of project management and provide their understanding of project management attributes across multiple dimensions of scope, time, cost, people, process, technology and organisation. Students will be taught the process activities, tools and techniques and case studies will be used to enhance their learnings with practical situational issues and challenges in project management. The conduct of the class sessions will include lectures, discussions, case study and group-work.

As projects invariably provide for the engagement of vendors for products or service, the course will teach the students on the vendor engagement and management process which is a significant responsibility for a project manager. The students will develop an understanding on vendor selection, contracts dealing, vendor performance and relationship handling to enable good collaboration with external partners for a successful project closure.

Upon completion of the course, students will be able to:

- Describe and analyse the business and organisational imperatives for projects, the success factors and the pitfalls
- Analyse the IT project characteristics, challenges and requirements
- Apply the project management process methodology and best practices
- Apply the key elements of the process including knowledge areas and stakeholders
- Evaluate the tools and techniques for effective project management
- Apply personal skills attributes for project management leadership
- Apply the vendor management process, its key elements including contracts, delivery, performance and relationship management

Global Sourcing of Technology & Processes

Standardization of business processes, advancements in information and communication technologies, and the continuous improvement of the capabilities of IT service providers around the world, among other factors, have led to an intense movement to “strategize” IT sourcing. In this course we will investigate how enterprise IT services are (out/in/back) sourced in the financial and other services industries. We will also draw relevant examples and lessons learnt from a variety of industry sectors and leading companies. Students will be exposed to the core issues involved in a variety of sourcing strategies (out/in/co-sourcing/captive), the industry best practices in managing IT sourcing and the emerging governance schemes for IT sourcing. In addition, we will analyse the supply side of sourcing ““ i.e., the vendor’s perspectives on managing sourcing relationships and how they deliver their promise of low-cost and high-quality services.

The format of the class will be seminar presentation, case studies discussion and role plays to simulate real live situations (persuasion, building client trust and engagement in sourcing disputes, negotiations, board presentations etc)

Upon completion of the course, students will be able to:

- Understand the key factors influencing IT sourcing decisions
- Investigate the risks and tradeoffs involved in various forms of IT sourcing
- Analyze sourcing partner’s strength and weaknesses
- Understand key aspects of IT sourcing contracts
- Recognize the importance of inter-organisational relationship management and performance monitoring in global sourcing relationships
- Understand the impacts of outsourcing (both economic and social)
- Analyse sourcing trends and topical areas that the industry is trending towards

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Digital Technologies and Sustainability (0.5 CU)

We are falling short to meet the Sustainable Development Goals (SDGs) by 2030. Digital technologies have disrupted many areas of our lives, but can it accelerate the world towards living more sustainably?

Journey through this course to unpack concepts related to sustainability and digital technologies such as AI, Blockchain and IoT. Dive into use cases where technologies have established breakthroughs in furthering the SDG goals across diverse sectors such as food, energy, well-being, poverty and education.

Understand the unique roles that governments, the private sector, non profit and consumers like yourself play. Be inspired and equipped towards a career involving the intersection of the economy, society and sustainability. Afterall, businesses are here to stay and there are no alternatives planets just yet.

Learning Objective

Upon completion of the course, students will be able to:

- Understand the basic tenets of sustainability such as circular economy and planetary boundaries
- Recognize the challenges in meeting the SDG goals by 2030
- Give examples of how digital technologies (focus on AI, Blockchain and IoT) can accelerate SDG goals
- Recognize the environmental impact of digital technologies
- Recognize the roles that the private sector, government and consumers play in sustainability
- Develop shifts in personal behaviour which impacts the environment (i.e. purchases, food, recycling, electricity consumption, travel choices)
- Inspire action (start-ups, jobs) towards a SDG goal in a developing or developed country

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Digital Technologies and Sustainability (0.5 CU)

The course equips students with the skills to integrate sustainability into digital transformation strategies. Covering topics like carbon footprint analysis, green software development, and circular economy principles, it combines theoretical foundations with practical applications. Through lectures, case studies, and projects, students will learn to design and implement sustainable digital solutions.

By the end of this course, students will be able to:

- Understand the environmental impact of digital infrastructure and its implications.
- Understanding of energy efficiency, carbon awareness, sustainable development practices, and how to better manage the lifecycle of digital infrastructures.
- Apply green software principles and green cloud migration strategies to reduce environmental impact.
- Integrate circular economy principles into technology lifecycle management.
- Develop metrics to measure the sustainability ROI in digital transformation projects.

Corporate & Consumer Financial Technology

The banking industry is undergoing a major transformation. Digital financial solutions have fundamentally changed how banking services are provided to customers. The use of new delivery channels, increasing automation, and finding new ways to improve service and reduce costs have become paramount for financial institutions.

This course explores current and emerging technology that is used within retail and corporate banking. It examines various types of customers, their needs, and how banking products and services address those needs. The course then examines technology architecture and solutions that are used by banks today as well as new technologies and business models that are being applied both by banks and Fintech companies.

The course consists of lectures, case studies, lab sessions, and assignments. The lectures explain banking processes, technology architecture, and business solutions. Topics include both traditional business models used by financial institutions as well as newer Digital Transformation strategies and Fintech approaches. Emphasis is placed on analysing real-world situations using case studies and gaining hands-on experience through lab exercises. Guest speakers from industry may also share their experiences.

Upon completion of the course, students will have gained knowledge on:

- Identifying core banking products and their process flows.
- Developing solutions, architecture supporting core banking products; challenges, criteria in evaluating solutions.
- Discerning the increasing importance of operational resilience and cybersecurity.
- Differentiating core banking services and channels offered to customers.
- Identifying linkages between business value and the processes and systems.
- Describing how Fintech relates to banking and is driving digital transformation.

Upon completion of the course, students should be able to explain the following:

1. Key banking concepts.
2. Banks' business model and lending
3. Drivers for digitalisation in banking.
4. Characteristics and architecture of Core Banking systems.
5. Types and characteristics of delivery channels.
6. Approaches to open banking.
7. The trade finance products and services that banks provide to companies.
8. Foreign exchange product structures and purposes.
9. Principles underlying operational resilience.
10. Cybersecurity risks and mitigations.
11. How Fintech relates to banking.
12. Digital transformation of banks.

Digital Banking & Trends

The financial services industry (FSI) has been undergoing transformational changes especially in the last decade. Drivers for these changes include competition, stringent regulations and digitization. FSI comprises of many types of financial players including banks, hedge funds and the Stock Exchanges. Within banks we have many sub types ranging from consumer or retail banks to investment banks. This course will focus on the banks as they generate significant jobs and are major contributors to the GDP.

Banks offer digital banking business products, processes and services to institutional and individual customers to enable them to transact for their personal needs or business needs. They include: save and invest surplus funds; obtain financing for ongoing business and personal needs; pay and receive money; conduct international trade activities; and manage financial risk with options and derivatives for hedging. Customer assets held in bank accounts, transactions involving these accounts, and related information and privacy require total and continuous security and protection.

This course is structured based on two inter-related modules that are built up sequentially:

1. Banking Foundation – The Essential Concepts
2. Digital Trends and Applications to Banking in Digital Transformation

Upon completion of the course, students will be able to:

- Describe and apply the foundational elements of the banking industry including the types of banks, products and services, delivery channels, risks and compliance
- Analyse banks using the Unified Banking Process Framework (UBPF)
- Apply digitisation to banking by differentiating how the different technologies are used by the banks
- Describe and analyse FINTECH trends in banking digitalisation and transformation

Data Science in Financial Services*

The financial services industry world-wide is facing more challenges than ever. An increased competitive environment with new challenger businesses re-writing whole sectors of the industry, together with being under increased regulatory scrutiny from both central banks and international bodies. To assist them, the financial services industry is collecting ever increasing amounts of data from their internal processes, customers and services, and applying state-of-the-art artificial intelligence algorithms to find value and service automation.

The knowledge and understanding that are needed for an artificial intelligence and data analytics professional in financial services includes, but is not limited to, data management, analysis, mathematics and statistics, machine learning and deep learning as well as an intimate knowledge of the specific financial services domain including the regulations and compliance surrounding it.

This module aims to bring these skills and knowledge together to bridge the gap between artificial intelligence techniques and their applications in financial services.

Using state-of-the-art artificial intelligence algorithms coupled with class discussion, labs and guest speakers from the industry, the students can understand how domain knowledge (such as compliance and regulation) interacts with artificial intelligence solutions and value chains through a range of industry cases.

This module is also designed to take advantage of the diversity in students' background to give varied points-of-view during each lab project and discussion. This closely emulates many financial services artificial intelligence environments. To ensure students have the required level of knowledge and skills, pre-requisites are set.

After completion of the module, students will be able to identify potential areas within the current financial services landscape shaped by local and regional regulators. Be able to state the challenges and potential artificial intelligence solutions that could be applied, and the relevant legal and ethical considerations associated. Students will be able to implement the chosen solution from inception to production. This will give students a significant edge in their financial services career.

Upon completion of the course, students will be able to:

- Understand the process to undertake when given an artificial intelligence and analytics project in financial services
- Understand and evaluate the range of challenges that artificial intelligence could be applied to
- Bridge the gap between artificial intelligence and domain knowledge in financial services during implementation of solutions
- Understand and value the process from collection of data to model validation and explainability and how domain knowledge interacts with each of these stages
- Understand and apply state-of-the-art artificial intelligence techniques including deep learning and natural language processing
- Be equipped with the necessary skills to perform well as an artificial intelligence professional in financial services
- Understand the legal and ethical implications of artificial intelligence solutions in financial services

Students will gain exposure through lectures, labs, group project work and discussions of the various approaches to AI in financial services. Students will be able to articulate and evaluate potential AI solutions to drive insights and value. Students will be exposed through labs, a group project and an individual project to the artificial intelligence process and be able to undertake a process from data collection to model validation and implementation in a financial services context.

Note: "Python Programming & Data Analysis" or "Computational Thinking with Python" is the pre-requisite for this course.

Financial Markets Systems & Technology

Financial Institutions are among the most intensive and innovative users of information technology. Voice- and paper-based trading have been replaced with electronic channels linking up market participants globally. Technology has equipped traders with real-time price and market information, and enables performance of complex data analytics to advance competitive edge. Open outcry trading floors at exchanges have been replaced by automated trade matching and straight-thru-processing (STP) has replaced error-prone paper-based settlements processing resulting in shorter settlement cycles.

But amid the loss of colorful trading jackets and the hype around technological advances, the fundamentals of markets, trading and risk management have not changed. And in order to provide products and services salient to the financial market community, one must understand these fundamentals.

This course introduces the roles within the types of markets, products and services, and how associated risks are harnessed and managed. Focus will be placed on the foreign exchange and equities products and the processes that support the trading and settlement of these instruments. The course will include the schematic architecture and design of the systems that support these processes. Learners will be placed in multiple simulations, taking on different roles from broker, to trader to risk manager, allowing them to gain insights to the practical application of what otherwise remains theory.

Upon completion of the course, students will be able to:

- Describe the linkages between business value and the processes and systems
- Recognize the various types of markets and market participants, and describe their revenue sources
- Differentiate the functions within a Financial Institution
- Explain the Trade Life Cycle
- Contrast the characteristics of the various financial instruments
- Derive the theoretical prices of Futures and Options
- Analyse markets using Technical Analysis
- Create Trading Strategies and manage their risks
- Manage Positions in news-driven markets
- Execute Orders correctly within markets
- Discuss the rigours of trading from first-hand experience
- Build and deploy an automated market making price quotation system
- Apply Options for Hedging and Speculation
- Calculate Historic Value-at-Risk and apply it to portfolios
- Derive and Apply Margin Requirements to portfolios
- Recognize market misconduct
- Describe the importance of market surveillance
- Sketch typical Financial Market system architecture and their core functionality

Digital Payments & Innovations

A payment is a transfer of monetary value. Under the hood of payment transactions are the products, the companies, the legal framework, the technology, and the financial institutions we rely on to facilitate the timely and uninterrupted exchange of value from one entity to another. In times of crisis, the importance of having a robust, efficient, and secure national and even global payment systems that market participants can rely on is even more pronounced.

A payment system (legal definition) is an arrangement which supports the transfer of value in fulfilment of a monetary obligation. Simply put, a payment system consists of the mechanisms - including the institutions, people, rules and technologies - that make the exchange of monetary value possible.

This course "Digital Payments & innovations" takes an overall look at the payment landscape viewing consumer, business and wholesale payments. It presents a depiction of the changing environment and delineates the dynamic payment ecosystem, helping us understand the possibilities as well as the limits to change. It covers payments for individuals, organisations and banks, and all of their possible permutations.

The course is aimed at students who are interested in both domestic and cross border payment systems, particularly those who aspire to a) work in a bank's T&O (technology and operations) as an architect, business analyst or project manager, or b) work in a non-bank FinTech provider of alternative payment services.

Upon completion of the course, students will be able to:

- Describe and explain the payment industry, especially the key and critical aspects of the payment infrastructure, the major functions, and the roles and responsibilities of key stakeholders/participants
- Present the major payment systems, the payment networks and methods available in the market covering these key areas:
  - » Singapore's local market e.g., clearing house, NETS, Fast And Secure Transfers (FAST)
  - » Global market e.g., PayPal, VISA, CLS,
  - » Standards and messaging format e.g. SWIFT, ISO, CEPAS, (also SEPA)
- Payment related Innovations (e.g. Open API, telco-based mobile money, blockchain technology, cryptocurrencies, and non-bank FinTech alternative payment providers such as AliPay, Stripe, Square, and TransferWise.)
- Identify appropriate sources and provide an update on developments and emerging trends including possible impact of political and economic climate in key jurisdictions, eg; the payment services directive in the European Union
- Demonstrate awareness of key functions of payment networks and methods such as:
  - » Optimised and secured integration links
  - » Efficient operational batch processing e.g. awareness of cut-off times
- Articulate the major issues and problems associated with payment systems and Identify payment security threats, vulnerabilities, risks, and necessary controls/mitigation including (but not limited to):
  - » Privacy safeguards
  - » Resiliency, high availability
- Give examples of the anticipated benefits and other impacts associated with e-payment system implementation
- Provide examples of typical system requirements for e-payment systems
- Differentiate payment system objectives and technological characteristics (e.g. centralized vs distributive architecture; on-line vs off-line processing; wire and wireless communication features)

RiskTech & RegTech*

Along with sales, risk and regulatory concerns determine the success or failure of financial institutions. When banks misprice risk associated with financial products or take on too much risk, they endanger their overall profitability. Likewise, when legal and regulatory compliance are mismanaged, banks can incur substantial fines, suffer reputational damage, and become subject to ongoing regulatory scrutiny. Accordingly, efficient and effective management of risk and regulatory compliance is a core focus for banks' management. Because of its mathematical nature, risk calculation, extensively leveraged technology for several decades. On the other hand, a long-standing approach that banks have used to deal with gaps in regulatory compliance and increasing regulation has been to "throw more bodies" at the problem. This approach has been costly, inefficient, and, in some cases, ineffective. As a result, Regtech solutions have been developed that help banks use technology to address compliance-related challenges.

This course begins by providing an introduction to Risktech, technology that is used to support banks' risk management activities. It reviews the main types of risks that banks encounter: market risk, credit risk, and operational risk and the processes and techniques used to measure those risks. Challenges related to managing risk data and performing risk calculations are reviewed along with related technology approaches. The course then goes on to review the purpose and application of bank regulation and common causes of regulatory compliance failure. With an understanding of relevant regulatory-related problems, different types of Regtech solutions are be examined.

Upon completion of the course, students will gain an understanding of:

- The following aspects of risk management:
  - » Basic concepts related of market, credit, and operational risk
  - » The principle behind and ways of calculating value at risk (VaR)
  - » The technologies that banks use to support risk management activities
- The following aspects related to Regtech:
  - » Purpose and concerns of bank regulation
  - » Challenges banks face related to regulatory compliance
  - » Types of Regtech solutions available and the benefits that they provide

Note: "Python Programming & Data Analysis" or "Computational Thinking with Python" is the pre-requisite for this course.

Quantum Computing in Financial Services

Quantum computing is now being realised at an ever-increasing pace. Quantum advantage has been demonstrated and the underlying technology continues to advance weekly. While everyone talks about the speed of quantum computers, the power of this technology is not just in how fast calculations can be performed but also how accurate. The overall objective of the course is to understand quantum computing, how it differs from classical computing and what the main applications are, now and in the future. Furthermore, you can experience programming real quantum computers and explore the quantum world.

Upon completion of the course, students will be able to:

- Explain the fundamentals of quantum computers
- Recognize the advantages and disadvantages of quantum computers
- Programme quantum computers
- Recommend quantum computers for the correct problem types
- Predict advancements in quantum computing

Fintech Innovations & Startups

Fintech is the creative integration of emerging business models and digitalization that results in advancing financial and social impact. The ultimate goal is to advance societal financial needs effectively, efficiently and safely.

The Fintech industry is one of the fastest growing sector with major impact and consequences on the banking industry. In 2018, US$32.6 billion was invested in Fintech (Accenture 2019 Fintech Report). Digitalisation is the key enabler for many of the innovations occurring in the financial services industry.

This course, Fintech Innovations & Startups will be divided into 2 main sections: Section 1 will include Fintechs and Innovation and Section 2 will include the concepts and characteristics of Startups and key practices for successful startups.

The course will enable students to understand the fundamentals of Fintech, the nomenclature used in the industry, the ecosystem of Fintechs, the nature of innovation, the drivers for innovation in the financial industry, Fintech trends, the business impact of Fintech, digital banks, the methodologies for startups, and incubation best practices that leads to successful startups. This course is actively supplemented by Fintech industry partners as guest speakers, FINTECH co- founders, visits to innovation centres etc. so as to broaden the scope from class room learning to practice-based learning.

Upon completion of the course, students will be able to:

- Analyse the characteristics of Fintechs & startups
- Identify Fintech and startup eco-system stakeholders and their roles
- Differentiate the types of incubators and incubation best practices for successful startups
- Apply innovation frameworks and methodologies for startups
- Develop fund raising and investment valuation knowledge
- Develop financial innovations that positively impact customers
- Develop effective pitching and communication skills of successful startups
- Identify emerging form of Fintechs such as digital banking platforms providers; neo banking challengers and trends

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Digitalised Currencies and CBDCs (0.5 CU)

The course “Digitalized Currencies and CBDCs” explores the intersection of emerging technologies, digital currencies, and Central Bank Digital Currencies (CBDCs) within the context of the evolving internet landscape known as Web3. Participants will gain a comprehensive understanding of the technological foundations, economic implications, and regulatory frameworks surrounding digital currencies and CBDCs. The course will cover the progression of web 1.0 to Web3, as well some of the foundational principles such as the mechanics of blockchain.

Upon completion of the course, students will be able to:

- Understand the evolution of the internet from Web 1.0 to Web3 and the role of decentralization in this progression
- Examine the landscape of digital currencies, including cryptocurrencies, stablecoins, and utility tokens, with a focus on major players like Bitcoin and Ethereum
- Investigate the integration of digital currencies into decentralized finance (DeFi) ecosystems, understanding the role of smart contracts and evaluating risks and opportunities
- Examine future trends and innovations in Web3 and digital currencies, staying informed about emerging technologies and their potential impact on financial systems
- Explore the foundational technologies of Web3, including blockchain, smart contracts, and decentralized applications (DApps)
- Analyze the concept and purpose of Central Bank Digital Currencies (CBDCs), studying real-world case studies and their economic implications
- Explore the global regulatory landscape for digital currencies and CBDCs, assessing privacy and security concerns, and identifying challenges and potential solutions for regulatory harmonization
- Navigate the evolving landscape of digital finance, empowering them to contribute meaningfully to discussions and decision-making in this dynamic field

Students will gain exposure through lectures, labs, and individual projects based on their work and research on NFTs and CBDCs

Tokenised Assets and NFTs (0.5 CU)

"Tokenized Assets and NFTs," is a cutting-edge course designed to explore the intersection of blockchain technology, decentralized finance (DeFi), and the transformative world of non-fungible tokens (NFTs). In this dynamic and forward-thinking program, participants will delve into the next evolution of the internet, Web3, and its profound impact on the creation, distribution, and management of digital assets.

Upon completion of the course, students will be able to:

- Understand the decentralized nature of Web3, in terms of the impact on data ownership, privacy, and security
- Understand tokenization and its application in representing real-world assets on the blockchain
- Investigate real-world applications of tokenized assets, including real estate, intellectual property, etc
- Examine future trends and innovations in Web3 and digital currencies, staying informed about emerging technologies and their potential impact on financial systems
- Develop a deep understanding of blockchain technology and its role in decentralization
- Understand the technology, standards, and use cases of NFTs
- Gain insights into the legal and regulatory landscape surrounding tokenized assets and NFTs
- Apply theoretical knowledge through hands-on projects, building and deploying tokenized assets and NFTs

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AI in Financial Markets Forecasting (0.5 CU)

The course will cover the use of AI techniques for time series modelling and forecasting for financial applications, e.g. portfolio management. It will cover traditional, machine learning and deep learning-based techniques. The course will also cover the latest developments, e.g. use of network and multimodal data for time series modelling and forecasting as well as foundational models for time series modelling.

Cybersecurity Technology & Applications

This course provides an introduction to cybersecurity. The focus is on basic cryptographic techniques, user authentications, software security, and various network security topics. The course emphasizes on the applications of such technology in real-world business scenarios, with case studies that examine how these ideas can be used to protect existing and emerging applications. Examples include secure email communications, secure electronic transactions over the Internet, secure e-banking, data confidentiality and privacy in cloud computing, and secure protocols in realistic networking setups. Although the course covers fundamentals of cryptography, our emphasis is not on its mathematical background and security proofs, but rather on how such building blocks could be applied to satisfy business, communication, and networking needs.

Upon completion of the course, students will be able to:

- Understand basic security concepts, models, algorithms, and protocols
- Conduct basic software vulnerability analysis and construct corresponding exploits
- Design and implement secure user authentication on Internet facing servers
- Formulate security requirements for real-world computing applications
- Analyze latest security mechanisms in use

Spreadsheet Modelling for Decision Making

Managers often need to make important decisions related to different business challenges. Understanding how to build models to represent the business situation, analyse data, perform computations to obtain the desired outputs, and analyse the trade-offs between alternatives, will support good decision making. This course focuses on using Microsoft Excel as a spreadsheet tool to build such decision models and to do business analysis. Students will be able to analyze trade-offs and understand the sensitivity impact of uncertainties and risks. The key emphasis of this course is on developing the art of modeling, rather than just learning about the available models, in the context of managing IT and operations decisions.

The primary focus is on using personal computers as platforms for soliciting, consolidating, and presenting information (data, assumptions and relationships) as a model for a variety of business settings; consequent use of this model to drive understanding and consensus towards generating possible actions; and finally, the selection of a final course of action and assurance of execution success.

Upon completion of the course, students will be able to:

- Formulate business problems and integrate business analysis skills (statistics, mathematics, business processes, and quantitative methods) to model and appraise broad business problems
- Acquire computer skills to become motivated to self-learn problem analysis and know where to get such information and system resources
- Associate with a variety of software solutions (e.g. add-ins) and acquire competency in using Excel as an effective tool for analysis, model verification, simulation and management reporting, for possible use in other courses in their study program and professional career

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IT Project & Vendor Management

The aim of this course is to equip the students with the essential knowledge for leading and directing IT projects for successful implementation. The module will introduce students to key elements of project management and provide their understanding of project management attributes across multiple dimensions of scope, time, cost, people, process, technology and organisation. Students will be taught the process activities, tools and techniques and case studies will be used to enhance their learnings with practical situational issues and challenges in project management. The conduct of the class sessions will include lectures, discussions, case study and group-work.

As projects invariably provide for the engagement of vendors for products or service, the course will teach the students on the vendor engagement and management process which is a significant responsibility for a project manager. The students will develop an understanding on vendor selection, contracts dealing, vendor performance and relationship handling to enable good collaboration with external partners for a successful project closure.

Upon completion of the course, students will be able to:

- Describe and analyse the business and organisational imperatives for projects, the success factors and the pitfalls
- Analyse the IT project characteristics, challenges and requirements
- Apply the project management process methodology and best practices
- Apply the key elements of the process including knowledge areas and stakeholders
- Evaluate the tools and techniques for effective project management
- Apply personal skills attributes for project management leadership
- Apply the vendor management process, its key elements including contracts, delivery, performance and relationship management

Global Sourcing of Technology & Processes

Standardization of business processes, advancements in information and communication technologies, and the continuous improvement of the capabilities of IT service providers around the world, among other factors, have led to an intense movement to "strategize" IT sourcing. In this course we will investigate how enterprise IT services are (out/in/back) sourced in the financial and other services industries. We will also draw relevant examples and lessons learnt from a variety of industry sectors and leading companies. Students will be exposed to the core issues involved in a variety of sourcing strategies (out/in/co-sourcing/captive), the industry best practices in managing IT sourcing and the emerging governance schemes for IT sourcing. In addition, we will analyse the supply side of sourcing "" i.e., the vendor's perspectives on managing sourcing relationships and how they deliver their promise of low-cost and high-quality services.

The format of the class will be seminar presentation, case studies discussion and role plays to simulate real live situations (persuasion, building client trust and engagement in sourcing disputes, negotiations, board presentations etc)

Upon completion of the course, students will be able to:

- Understand the key factors influencing IT sourcing decisions
- Investigate the risks and tradeoffs involved in various forms of IT sourcing
- Analyze sourcing partner's strength and weaknesses
- Understand key aspects of IT sourcing contracts
- Recognize the importance of inter-organisational relationship management and performance monitoring in global sourcing relationships
- Understand the impacts of outsourcing (both economic and social)
- Analyse sourcing trends and topical areas that the industry is trending towards

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IoT: Technology & Applications

In the near future, we can envision a world in which billions of devices can sense, communicate, and collaborate over the Internet, in the same way that humans have interacted and collaborated with one another over the World Wide Web. This vision is now known as the Internet of Things. The knowledge created from these interconnected objects can potentially offer new anticipatory services to improve our quality of lives and can be applied to various application domains - such as smart cities, smart homes, logistics and healthcare. In line with worldwide efforts to realize smart cities through IoT technologies, this course is intended to equip students with the state-of-the-art in IoT technologies, to enable them to conceptualize practical IoT systems to realize citizen-centric applications.

Upon completion of the course, students will be able to:

- Define and understand what is IoT
- Describe the impact of IoT on society
- Evaluate the potential and feasibility of IoT applications for large-scale smart city applications
- Acquire knowledge and gain hands-on experience in state-of-the-art IoT component technologies "" such as things, network connectivity and sense-making
- Conceptualize a sustainable and scalable end-to-end IoT system that generates actionable insights for stakeholders to solve real world problems

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Business Applications of Digital Technology

Technologies play an important enabling role in digital transformation by improving efficiency and increasing productivity. As new disruptive know-hows continue to be developed, it is vital to keep up to date on the state-of-the-art knowledge in advanced science and digital technology. In this module, you will learn about use cases and best practices in enabling technologies such as data science, artificial intelligence, mobile and wearables, blockchain, 5G and communication technologies, cloud computing, IoT, social computing, and APIs/microservices.

Upon completion of the course, students will be able to:

- Understand the fundamentals of enabling digital technologies and their trends
- Apply digital technology drivers and use cases
- Select relevant digital technology for different business scenarios
- Assemble a suite of appropriate digital technologies to enable digital transformation

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Blockchain Technology

This course explores the technology of blockchains and smart contracts. The fundamentals of blockchains and smart contracts are first explained and then the similarities and differences of public and private blockchains are shown. Various blockchain platforms are considered as well as the end-to-end implementation of a range of services, for example media rights and supply chains. The course has hands-on development, deployment and execution of smart contracts using Solidity for Ethereum. Emphasis is placed throughout the course on analysing real-world situations using case studies and gaining hands-on experience with coding smart contracts. Guest speakers from companies using blockchains and blockchain vendors will share their experiences.

Upon completion of the course, students will be able to:

- Understand use cases for blockchain.
- Gain a depth of understanding on blockchain technology such as the use of encryption and data storage structures.
- Develop Smart Contracts use cases in relevant areas.
- Understand the future of blockchains and the role that smart contracts could play in the future.

Web3 Fundamentals

With the advent of Bitcoin, a cryptographically-enabled peer-to-peer digital payment system, blockchain together with a whole package of distributed ledger technologies have been gaining attention from both academia and industry in the last decade. Furthermore, the recent years have witnessed tremendous momentum in the development of a whole cluster of technologies including blockchain and distributed ledger technologies, privacy-enhancing computation, data pricing, data auditing among others, largely due to the impressive rise in the market capital of these digital tokens and the growth of digital economy.

This cluster of technologies addresses primarily two core pillars of collaborative intelligence and tokenized economy, which are usually termed trendily as "Web3".

More and more industries, from banking and insurance, to supply chain and e-commerce, are quickly realizing the great potential in Web3 technology in efficiency boost, process automation and secure data sharing across otherwise isolated data silos. Web3 is set to nurture a whole set of new economies.

This course introduces you to the Web3 ecosystem, from concept to evolution, from technologies to applications. Students will learn the defining characteristics of Web3 technologies and learn to design, develop and evaluate the application of Web3 technologies in various settings for problem solving.

Low Code Application Development

CLow Code Application Platforms (LCAP) are trending in industry. Government agencies in Singapore now require LCAP in their software outsource requirements, including for public facing applications. Both major Telco's in Singapore are using LCAP. Banks are ramping up their adoption of LCAP.

This course exposes students to LCAP using OutSystems, a leading LCAP provider. The course starts out covering architecture and design best practices, followed by weekly hands-on lab exercises covering data modeling, processing logic, API development, and user interface development. Student teams will develop a complete application for their term project. By the end of the course, students will be able to develop commercial-grade full-stack applications without writing any code.

Computational Thinking with Python

Problem-solving for real-word issues involves systematically approaching problems and devising solutions that can be executed through a computer program. Computational thinking, as the pivotal skill for problem-solving, can be applied to solve a wide range of problems with quantitative and strategic constraints.

In this course, students will acquire proficiency in the Python programming language with the objective of problem-solving using computational thinking, which includes decomposition, pattern recognition, and abstraction. By the end of the course, students will be able to create concise Python programs to solve computational problems in specific contexts.

Statistical Thinking for Data Science

Recent technological advances have enabled more seamless ways of generating and collecting larger volumes and varieties of data. Statistical Thinking, a crucial branch of Mathematics, serves as the cornerstone for visualising, analysing, interpreting, and predicting outcomes from the data. Descriptive Statistics forms the foundation by providing fundamental tools for summarising data, while Inferential Statistics empowers us to draw inferences and deductions about broader populations based on sampled data.

In this course, students will learn to explore and present data to discover underlying patterns and trends, apply statistical thinking and computing to analyse data, and convert them into meaningful information using Python programming. The first half of each lesson will be dedicated to equipping students with statistical thinking concepts, while the second half will be focused on the practical aspects of implementing the concepts using Python and applying them to Data Science problem statements.

Modern Software Solution Development

Constructing/deploying large-scale software solutions to support ever-changing business needs has been a challenging problem. Modern software solutions often need to incorporate emerging AI services such as large language models, computer vision, audio analytics, etc., to deliver better values and insights for businesses.

In this course, students will learn the fundamentals of software engineering, focusing on the integration of new AI services and applications into modern software systems. Students will experience building and deploying a scalable and extensible software system using a component-based design, microservices architecture, and cloud-native technologies.

Global Exposure Project (SMU-XO)

The Global Exposure Project (GEP) is a joint initiative between MITB and Sogang University, offered as a 1 CU practicum module, over a 5-week period during the July Term of the academic calendar. This immersive, cross-institutional module is structured to cultivate collaboration, innovation, and hands-on problem-solving.

Its core objective is to strengthen students' problem-solving capabilities by engaging them with real-world industry challenges, exposing them to international business ecosystems, and fostering cross-cultural teamwork. The GEP offers students a real, hands-on global and cross-cultural learning opportunity that bridges academic theory with practical application. Drawing on the knowledge and skills acquired in the MITB programme, students will engage with real-world challenges in a global setting.

Upon completing the GEP, students will be able to:

- Acquire practical industry insights from practitioners and subject matter experts
- Identify, gather, and/or generate relevant data and information to support project objectives
- Strengthen critical thinking through literature review, research, and direct analysis of problems and datasets
- Analyse and synthesise data to produce new insights and understanding
- Assess the strengths and limitations of existing research, techniques, and methodologies
- Select, justify, and apply appropriate methodological approaches to address GCP problem statements
- Manage the project lifecycle, track progress, and adapt strategies as needed
- Enhance academic and professional competencies, including tools, techniques, practices, and conceptual frameworks
- Articulate the limitations of their work and the complexity of knowledge creation and interpretation
- Communicate project outcomes clearly and effectively through structured, engaging presentations
- Benefit from ongoing mentorship and professional guidance throughout the project
- Exhibit independence, accountability, and effective time management

PRACTICUM

Internship (2 CUs)

The MITB Internship is an experiential learning experience for students to apply knowledge acquired in the MITB program within the professional setting. The internships are aligned with the aims of the MITB program and students' respective tracks. It provides students with career-related work experience and understand how their skills and knowledge can be utilized in the industry. Students are able to demonstrate functioning knowledge, and identify areas of further development for their future careers. It also provides a chance for students to establish the professional network within the profession.

Upon completion of the internship, students will be able to:

- Identify their own strengths, interests, skills and career goals
- Discover the wide range of companies and functions available and the skills needed for job success
- Develop communication, interpersonal and other critical soft skills required on the job
- Develop the work ethic and skills required for success in the internship
- Build a record of internship experiences
- Identify, document, and carry out performance objectives related to the internship
- Build professional relationships with internship supervisors, mentors, learning buddies, and other colleagues
- Prepare an engaging, organized, and logical presentation summarizing the internship
- Receive guidance and professional support throughout the internship
- Demonstrate independence, responsibility, and time management

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Capstone Project (2 CUs)

The MITB capstone project is an extensive, applied practice research project that is undertaken by students, supervised by SMU faculty members who have specific expertise and interest in the topic, and sometimes sponsored by external companies. It provides the students with an individualized learning experience to integrate and synthesize the skills, theories, and frameworks they have learnt in MITB programme. The project gives students an opportunity to delve in greater depth, into business challenges or topics in financial technologies, analytics, or AI field. Students shall identify a problem, develop the approach and methods needed to address the problem, and conduct the research and present the findings in both oral and written formats.

The capstone project experience aims to provide an authentic and practical interdisciplinary learning experience to take knowledge and theory they have learned in MITB and apply in a real-world setting. Upon completion of the capstone projects, students will be able to:

- Gain theoretical and practice insight, including background and new information on topics within the students' respective tracks
- Locate, collect and/or generate information and data relevant to the project
- Develop critical thinking through reading, research, and hands-on analysis of the problem and dataset
- Evaluate the strengths and weaknesses of current research findings, techniques and methodologies
- Select, defend, and apply methodological approaches to answer the project's questions
- Analyze the information and data, synthesize them to generate new knowledge and understanding
- Manage the research project, monitor its progress, refine, and pivot the approaches as needed
- Contribute to the development of academic or professional skills, techniques, tools, practices, ideas, theories or approaches
- Describe the limitations of the work, the complexity of knowledge, and of the potential contributions of interpretations and methods
- Present the project and its findings in an engaging, organized, and logical manner, summarizing the entire capstone project
- Receive guidance and professional support throughout the project
- Demonstrate independence, responsibility and time management